EVALUATING EXISTING WATER QUALITY INFORMATION IN THE SIERRA NEVADA NETWORK FOR VITAL SIGNS WATER QUALITY MONITORING PLAN

BACKGROUND

National Park Service (NPS) policy and recent legislation (National Parks Omnibus Management Act of 1998) requires that park managers know the condition of natural resources under their stewardship and monitor long-term trends in those resources in order to fulfill the NPS mission of conserving parks unimpaired. The NPS has developed an Inventory & Monitoring program to fill in knowledge gaps in baseline data about natural resources in parks and to design and implement long-term monitoring that will enable managers to develop broadly-based, scientifically sound information on the current status and long term trends in the composition, structure, and function of park ecosystems (Fancy 2000).

To improve the efficiency of an inventory and monitoring program, the NPS created networks of parks that are linked by geography and shared natural resource characteristics. Placing parks in networks encourages collaboration, information sharing and reduces costs of inventory & monitoring efforts. There are 32 networks nationwide. The Sierra Nevada Network (SIEN) includes the following NPS administered units in California: Devils Postpile National Monument (DEPO), Sequoia and Kings Canyon National Parks (SEKI) and Yosemite National Park (YOSE).

The National Park Service's Vision and Implementation Strategy for Park Vital Signs Monitoring (NPS, October 2000) describes the monitoring planning and design efforts. Water quality is one of the components of this program. The development of network monitoring programs is a complex process that requires a front-end investment in planning and design to ensure that monitoring will meet the most critical information needs of each park and produce scientifically credible data. The Washington Office of NPS has identified three phases of monitoring planning and plan development for vital signs monitoring networks and has provided a detailed outline of plan content (Attachment A). Phase I is concerned with synthesizing existing information on monitoring in the parks and partners, identifying key management issues and developing conceptual models to support planning efforts. Phase II focuses on selecting vital signs indicators and documenting the rationale and process.

This task agreement addresses background work needed to complete Phase I and II of the monitoring planning, specifically water quality. Phase III will deal with monitoring design.

OBJECTIVES

1. Retrieve water quality data from STORET Legacy, STORET X, and USGS NWIS databases, Import pertinent data files into MS Access for summary statistics and presentation..
2. Acquire additional water quality data for SIEN units from NPS, USGS, state agencies or others that are not already included in the databases specified in Objective 1, and update the MS Access files with all additional datasets when quality assurance measures are met by the additional databases.
3. Provide location data (X,Y coordinates in UTM or Lat/Long units) of water quality and quantity sampling locations with unique location IDs that allow NPS staff to create a GIS layer of all sample sites.
4. Produce FGDC-compliant metadata for datasets created in this project.

5. Conduct a literature search and do an annotated bibliography of agency reports or published articles related to water quality in Sierra Nevada parks.
6. Document park-specific past, and present management concerns regarding water quality issues, and attempt to identify future concerns.
7. Characterize existing water quality and identify data gaps based on: (a) water quality conditions reflected by existing data; (b) input from NPS regarding current, past, and potential future challenges to water quality, and (c) extent and intensity of current water quality monitoring.

IMPLEMENTATION PLAN

This will be a cooperative effort between Sierra Nevada Network staff and Colorado State University (CSU) Professor Dr. John D. Stednick. The primary databases that will serve as the starting point for this project are available through the *Baseline Water Quality Data Inventory and Analysis* reports that were produced for SIEN parks between 1994 and 1998 (WRD/NPS I&M 1994, 1997, and 1998) and through USGS-WRD. These databases, STORET (Legacy and X) and NWIS, will be combined into an MS Access database to facilitate updating with water quality data that are more recent or that are from sources not included in the WRD summaries. These datasets will be identified through contacts with NPS staff, state agencies, USGS and others who have collected water quality data in SIEN parks. Criteria for inclusion of additional datasets will be developed by NPS and CSU staff:

Literature searches and summaries will be done through contacts with NPS and USGS staffs, NatureBib searches, and on-line searches of peer-reviewed journals. Summaries of water quality management issues and concerns will require queries of park staffs and review of pertinent park planning documents.

NPS agrees to:

1. Provide CSU information and contacts for acquiring new water quality datasets, assessing management issues and concerns and doing literature reviews.
2. Help develop criteria for inclusion of new datasets in the existing set of water quality data.
3. Provide office support (including telephone, internet, and computer services) at Sequoia and Kings Canyon National Parks for the duration of the project.
4. Meet with CSU staff periodically for direction and to conduct project reviews.
5. Brief CSU staff on park safety program (accident prevention, who to contact in case of emergencies, etc.).
6. Provide funds for any additional MS Access training, if needed.

CSU agrees to:

1. Provide the Principal Investigator for the project, John D. Stednick, Ph.D.
2. Provide an assistant to conduct the data and literature acquisition, summary and syntheses for the project.
3. Conduct all work identified in the objectives and deliverables sections.
4. Provide progress and final reports on the project.
5. Participate in a Sequoia and Kings Canyon NP water resources scoping workshop.

DELIVERABLES

- MS Access water quality database with FGDC-compliant metadata input to SIEN metadata database SMMS and data dictionary.
- List of all new datasets added and metadata to document these datasets.
- Database includes specific locations of water quality and quantity sampling stations so that NPS staff can create a GIS layer of these sample sites for each park.
- Progress report (2-3 pages)
- Monthly updates (through conference calls and/or meetings between key CSU and NPS staff)
- Final report including: 1) Stand-alone executive summary similar to that for the *Baseline Water Quality Date Inventory and Analysis* reports (WRD 1994, 1997, and 1998); 2) specific methods used to accomplish tasks associated with database update (contacts made, criteria used for including databases, data quality controls, etc.); 3) annotated bibliography and any recommendations for additional searches or sources of information; 4) park-identified water quality management issues, and any water quality problems that can be identified from the existing data (exceedances of state and/or federal standards, sensitivity to acid deposition, etc.); 5) data gaps identified from available data and needs identified by park staff. 6) potential criteria for identifying long-term monitoring sites, developed in cooperation with NPS staff. 7) A statement acknowledging the sponsorship and assistance of the NPS in conducting the summary and analysis.
- One hard copy and an electronic copy of the final report will be provided to the SEKI Aquatic Ecologist and the SIEN Network Coordinator, and two hard copies and an electronic copy of the final report will be provided to the CPCESU.

TIMELINE

Start date: November 3, 2003
Progress Report: January 16, 2004
Draft Final Report and associated data and metadata: March 31, 2004.
Final Report: April 30, 2004

BUDGET

Personal Services	Assistant ($15.50/hr + 0.9% benefits)	$17,570
Travel	Principal Investigator + Assistant	$1,560
Indirect Costs	CESU indirect costs @15%	$2,870
Total		$22,000

LITERATURE CITED

Fancy, S. 2000. Monitoring Natural Resources in our National Parks. http://www1.nature.nps.gov/im/monitor/.

Water Resources Division and NPS Inventory & Monitoring Program. 1994. Baseline Water Quality Data Inventory and Analysis, Yosemite National Park. National Park Service, Dept. of the Interior.

Water Resources Division and NPS Inventory & Monitoring Program. 1997. Baseline Water Quality Data Inventory and Analysis, Sequoia & Kings Canyon National Parks. National Park Service, Dept. of the Interior.

Water Resources Division and NPS Inventory & Monitoring Program. 1998. Baseline Water Quality Data Inventory and Analysis, Devils Postpile National Monument. National Park Service, Dept. of the Interior.

ATTACHMENT A

Development of Park Vital Signs Monitoring Programs
and Integration with Water Quality Monitoring

Peer review of the initial network information, analysis and decisions made in identifying potential vital signs for natural resource monitoring is required before the detailed design and protocol development work is done. Accordingly, this document describes a phased approach to the planning and design efforts, the implementation schedule, and the required format for network monitoring plans.

Networks may produce a single, integrated monitoring plan that included water quality monitoring, or a separate document for the water quality monitoring component that follows the detailed guidance for water quality monitoring developed by the Water Resources Division for the Vital Signs handbook (http://www.nature.nps.gov/im/monitor/handbook.htm).

1. Servicewide goals for vital signs monitoring

The following Servicewide goals for vital signs monitoring should be included in all network monitoring plans. The weighting placed on various goals may differ among networks, and some networks may choose to add additional network-specific goals, but it is proposed that these goals for vital signs monitoring should apply Servicewide:

- Determine status and trends in selected indicators of the condition of park ecosystems to allow managers to make better-informed decisions and to work more effectively with other agencies and individuals for the benefit of park resources.
- Provide early warning of abnormal conditions of selected resources to help develop effective mitigation measures and reduce costs of management.
- Provide data to better understand the dynamic nature and condition of park ecosystems and to provide reference points for comparisons with other, altered environments.
- Provide data to meet certain legal and Congressional mandates related to natural resource protection and visitor enjoyment.
- Provide a means of measuring progress towards performance goals.

2. Three-phase process for development of network monitoring plans:

The Phase 1 report should describe the formation of the network Board of Directors and science/technical committees and the results of the work involved in summarizing existing data and understanding of the park ecosystems, defining goals and objectives for the monitoring, developing draft conceptual models, and other background work that should be done before the initial selection of vital signs. The report includes most of the tasks and data compiled during Steps 1 and 2 and part of Step 3 of the 7-step "Recommended approach for developing a network monitoring program" that was included with the October 13, 2000 memo "New Park/Network Monitoring Program: Vision and Implementation Plan". A description of the 7-step approach can be downloaded from http://www.nature.nps.gov/im/monitor/approach.htm. The material developed during these steps forms the basis for Chapters II and III of the monitoring plan, as described in the attached outline. Networks should draft these two chapters of the plan and have them peer reviewed and approved by the regional I&M coordinator before selecting and prioritizing their vital signs or doing more detailed design and protocol development work.

The peer review should focus on the scientific basis for the planning and design of the network monitoring program. The Regional I&M coordinator will be responsible for selecting at least three peer reviewers for this phase of the planning and design work.

Some of the details that will be included in the final monitoring plan, such as identification of specific, measurable objectives and threshold values or "trigger points", will be developed later in the process and therefore will not be included in the Phase 1 report. The 3-phase design process is an iterative process, and the final monitoring plan will "cut and paste" much of the material from the Phase 1 report, but will include additional detail that is developed during Phase 2 and 3 of the design process.

The report for Phase 2 of the monitoring design will update and expand upon the material in Chapters II and III of the monitoring plan, but will also include the results of one or more scoping workshops and subsequent review to identify and do an initial prioritization of potential vital signs for natural resource monitoring. This involves parts of Step 3 as well as Step 4 of the 7-step recommended approach. The Phase 2 report should be a draft of Chapters II, III and IV of the monitoring plan, as described in the attached outline.

The Regional I&M Coordinator will also be responsible for selecting reviewers for the second phase of the work. Peer review for this phase of the work should include a management perspective as well as the scientific basis for the monitoring program. The report on this phase of the planning and design work will satisfy the requirements for meeting Performance Management Goal 1b3 "Vital Signs" for all parks in the network once it has been peer reviewed and approved by the Regional I&M Coordinator.

Phase 3 involves more detailed design work needed to draft the full monitoring plan as described in the attached monitoring plan outline. This may include a revision of priorities for vital signs monitoring to fit within budgets and to make efficient use of personnel once decisions on staffing and funding are made. This phase involves Steps 5, 6 and 7 of the 7-step recommended approach. The monitoring plan should include all of the chapters and appendices listed in the outline for the monitoring plan. The peer review process for this step will be addressed separately at a later time.

3. Implementation schedule for 3-phase process:

From the date that planning funds for vital signs monitoring are first made available, networks are expected to complete Phase 1 within 1-1/2 years, complete Phase 2 within 2 years, and submit a draft of the full monitoring plan within 3 years.

The Sierra Nevada Network has the following schedule for its monitoring plan:

Phase 1: October 1, 2004
Phase 2: October 1, 2005
Phase 3: DRAFT December 15, 2006; FINAL October 1, 2007

4. Outline and format for network monitoring plans

Each network of parks that receives funding from the Natural Resource Program Center to develop a monitoring program is required to prepare a monitoring plan describing the monitoring program and the various tasks and decisions that contributed to the final selection of indicators to be monitored. Sections of the monitoring plan will need to be peer reviewed and approved before the network is approved to continue with the development of the monitoring program, and the full monitoring plan that contains all of the material in the following outline will require peer review and approval before it is fully implemented. Monitoring plans should follow the outline below (network monitoring plans should include all of the chapters listed below, but networks are free to organize material within each chapter as appropriate to make the plan more easily understood and organized).

I. Executive Summary

II. Introduction and Background

- Explain the purpose of the monitoring program, including a summary of legislation, NPS policy and guidance, Servicewide and network-specific goals for monitoring, Servicewide and park-specific strategic goals for performance management that are relevant to the monitoring, and any statements from park enabling legislation that establish the need to monitor natural resources. Answer the question, “who is interested in the information provided by monitoring, and why?”
- List the objectives of the monitoring, including specific, measurable objectives bounded in space and time wherever possible.
- Give an overview of each park and its natural resources. More detailed descriptions of each park and its resources could be included in an appendix. What is the importance of the park’s natural resources in a regional or national context? For water quality monitoring, identify parks that have waters where constituents exceed water quality standards and are listed on state Clean Water Act 303d lists or constituents that may be threatened to become degraded. Also identify parks that have waters designated as Outstanding National Resource Waters or other special protective designations in their state water quality standards. Draft guidance for identifying these waters is contained in the Vital Signs Monitoring Handbook
- What are the most important management issues and scientific issues for each park? What are the most important agents of change and stressors that may cause changes in park resources?
- Give an overview of natural resource monitoring that is currently being done in each park or that occurred previously. Describe any widely-accepted monitoring efforts used in the general region by other agencies that provide opportunities for data comparability (putting the network’s data in context and assisting in interpretation of data collected in parks).
- Describe the overall process used to determine the goals and specific measurable objectives for the monitoring program, and to select the vital signs for monitoring park resources and providing the information needed to manage the parks.

III. Conceptual Models

- Provide a summary of the understanding of the park ecosystem, including conceptual models developed prior to and during the scoping process. This summary should focus on aspects of the ecosystem that are relevant to the monitoring program. Guidance and examples of conceptual models can be found at http://www.nature.nps.gov/im/monitor.

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(Note: Most of the background material and development of conceptual models described in Chapters II and III should be written up in a Phase 1 report, peer-reviewed, and approved by the regional I&M coordinator before the network selects and prioritizes its vital signs. The Phase 1 report may not include some material that may not be developed until later in the design process, such as specific, measurable objectives and threshold values or “trigger points”).

IV. Vital Signs

- List the vital signs selected for monitoring, the justification for why they were selected, and show how they fit with the conceptual ecosystem model. Provide a list or table describing the vital signs that were considered but not selected for monitoring and the reasons why they were not selected.
- Provide the results of scoping workshops and other efforts to identify the most important issues and data needs for parks in the network, and the criteria or process used to determine which components would be included in the monitoring program. For water

quality plans, identify pollutants that exceed water quality standards. Specific guidance for other water quality constituents that may serve as vital signs indicators is contained in the Vital Signs Monitoring Handbook (In development).
- List the specific, measurable objectives for each vital sign selected for monitoring, and wherever possible, give the threshold value or "trigger point" at which some action will be taken. The statistical "detection limits," given typical sample variability and chosen sample sizes, shall be low enough to insure that such threshold values or trigger points can be detected.

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(Note: A second round of peer review and approval of the Phase 2 report should occur after the initial list of vital signs and measurable objectives is determined, and prior to detailed work on sampling design, protocol development, database design, etc.)

V. Sampling Design
- Explain the need for an overall statistical sampling design that allows inferences to be made to areas larger than those actually sampled. Identify specific populations to be monitored, and sampling units.
- For each park, describe the approach used to determine where sampling will occur for each vital sign, including justification for collocating or not collocating sampling for various vital signs. Provide justification for the attributes used to stratify the park into sample units (e.g., cost of access, terrain features such as elevation and slope, soils or vegetation map). Describe what is known about average values and variability in the various strata and how the sampling scheme will insure that the value obtained will be representative of the target population being studied. If the variability and typical values in various potential strata is not well understood, typically pilot scale monitoring should be initiated to determine these values before the monitoring design is finalized.
- Detailed maps and descriptions of where samples will be taken can be included in the protocols or an appendix, but summarize the overall spatial design for each park here.

VI. Sampling Protocols
- Give an overview of each sampling protocol that will be used to monitor the vital signs. The full protocols should be included in an appendix. The overview should summarize the material in the Protocol Narrative for each protocol, including an overview of the resource issue being addressed, specific measurable objectives, sampling design, field methodology, data analysis and reporting, personnel requirements, and operational requirements. Generally accepted Standard Operating Procedures for the collection of data for constituents that may serve as water quality vital signs are provided in the Vital Signs Handbook (In development). Standard Operating Procedures (SOPs) used should be those that insure that the data are comparable with other large regional data sets, to the extent possible. Protocols should include a detailed discussion of Quality Assurance/Quality Control measures used to insure that data collected will be considered credible by those who will be using it, including NPS managers, state agencies, and other federal agencies.

VII. Data Management
- Overview of the process for entering, editing, storing, and archiving data collected by the various components of the monitoring program, including metadata procedures. See the Vital Signs Monitoring Handbook (In development) for special requirements for entering and managing water quality data in the Environmental Protection Agency's STORET database. The full Data Management Plan should be attached as an appendix.
- Provide an overview of the database design for the monitoring program.

VIII. Data Analysis and Reporting

- Describe how data collected by the monitoring program will be analyzed, including who is responsible and how often analysis will occur.
- Describe the various reports and other products of the monitoring effort, including what they will include, who the intended audience is, how often they will be produced and in what format, and who will be responsible for ensuring that data are analyzed and reported in a timely manner.

IX. Administration/Implementation of the Monitoring Program

- Describe the makeup of the Board of Directors and Science/Technical committees for the network of parks, and their role in developing the monitoring strategy and implementing and promoting accountability for the monitoring program.
- What is the staffing plan for the monitoring program? Who will be involved in the program, where will be they be stationed, and what is their role in the program?
- Integration with other park operations: describe how the monitoring program integrates with other park operations such as interpretation, law enforcement, and maintenance.
- Partnerships: Describe other agencies and individuals that are part of the monitoring program. List cooperative agreements and other partnership agreements that are in place.
- For field sampling efforts to be performed in house, describe how they will be supported in terms of staff training and/or previous experience, field equipment to be dedicated to the effort (vehicles, instruments), anticipated in-house lab work to support operation, maintenance, and calibration of equipment and its documentation, and the necessary safety considerations in performing field tasks. (Note: each Network may want to standardize their own Safety Plan to cover monitoring efforts, particularly in regard to water quality sampling)
- Periodic Reviews: explain the process and schedule for periodic reviews of the overall program and various components and protocols.

X. Schedule

- Summarize the frequency of sampling for the various components of the monitoring program (e.g., during what season of the year, and whether sampling should occur annually or once every several years.)
- Identify the target completion date for protocols still to be developed, or for other tasks that will require additional time to complete before a component of the monitoring will be implemented.

XI. Budget

XII. Literature Cited

XIII. Appendices

- Detailed descriptions of parks and their resources (optional)
- Workshop reports
- Sampling Protocols
- Database design details
- Data Management Plan